

THE EXTINCT TOOLACH WALLABY (MACROPUS GREYI)

FROM A SPRING MOUND IN NORTH WESTERN TASMANIA

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The last Toolach Wallaby seen alive appears to have been one held in captivity at Robe, South Australia, in 1927. Attempts had been made earlier (1923/4) to transfer the last known band to Kangaroo Island but "as a result of overmuch driving the few examples obtained were either dead or dead shortly after capture" and "owing to the extensive publicity given to the two expeditions . . . realization of the great rarity of the wallaby . . . survivors of the 1924 attempt have been wantonly killed for the sale of the pelt as a trophy" (Finlayson 1927). It was a species which had once been very numerous in South Australia, and was, according to Wood Jones (1923), "probably the most beautiful and elegant of all the wallabies".

At the time of European settlement *M. greyi* was found only in a small area of South Australia. Its range (according to Finlayson 1927) "was constituted by all that portion of the state which lies east of the 139th meridian and south of the 35th parallel, but its distribution throughout this tract was not uniform, and showed, rather, an increasing density from north to south, and probably, also a considerable hiatus in the mallee country of its north eastern corner".

Wakefield (1972) reported the presence of *M. greyi* bones in recent deposits in three cave sites in Western Victoria (McEacherns Cave, Mt. Hamilton and Warrnambool). *M. greyi* remains have also been reported (Hope *et al.* 1977) from Kangaroo Island in deposits dated between $10,940 \pm 160$ and $16,110 \pm 100$ years B.P. (although one specimen was found at a higher, undated, level). We report here on fossil specimens from north western Tasmania, a considerable range extension for the species.

THE SITE

The spring mounds of north western Tasmania are well known through the work of Gill and Banks (1956). These authors also reinvestigated a number of Pleistocene fossil sites (Mowbray and Pulbeena Swamps and Scotchtown Cave). In the last ten years this area has become one of the most thoroughly studied in Australia in the field of Quaternary research. Further work has been done at Pulbeena Swamp (Banks *et al.* 1976), new fossil sites have been found at Montagu (Murray and Goede 1977) and archaeological work has been carried out at Rocky Cape, West Point (Jones 1971) and Hunter Island (Bowdler 1974).

The mound springs at Mowbray Swamp (Gill and Banks 1956) are usually 3-6 metres high and have highly mineralised water flowing from the top which causes swampy conditions at the base. A section cut into one mound showed the presence of 17 layers (average thickness 15cm) alternating between shell and peat layers. A date of 37,760 years was obtained for such deposits and it was recorded that *Nototherium* remains had been found in the area.

Although the two sites are only about 12km apart, the spring mounds investigated by us at Edith Creek, differ in certain respects from those at Mowbray Swamp. The fossil site (Figure 1) is on the Waratah Plain, some 4km west of Edith Creek (40° 57'S 145° 3'E). The site is situated on the flood plain about 1km to the west of the Duck River which runs between the Christmas Hills to the west and an unnamed range of hills to the east.



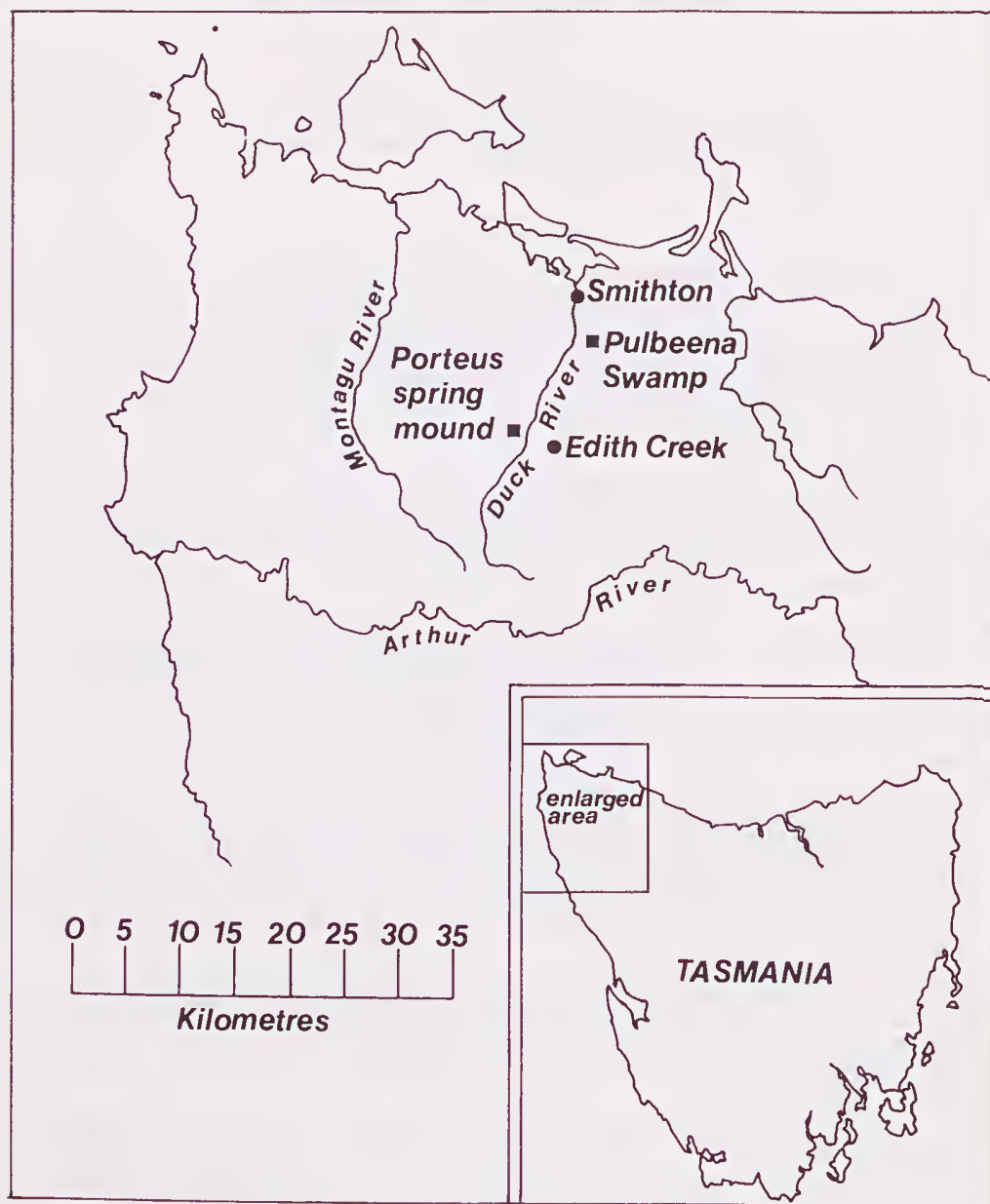


Figure 1 Map of site locality.

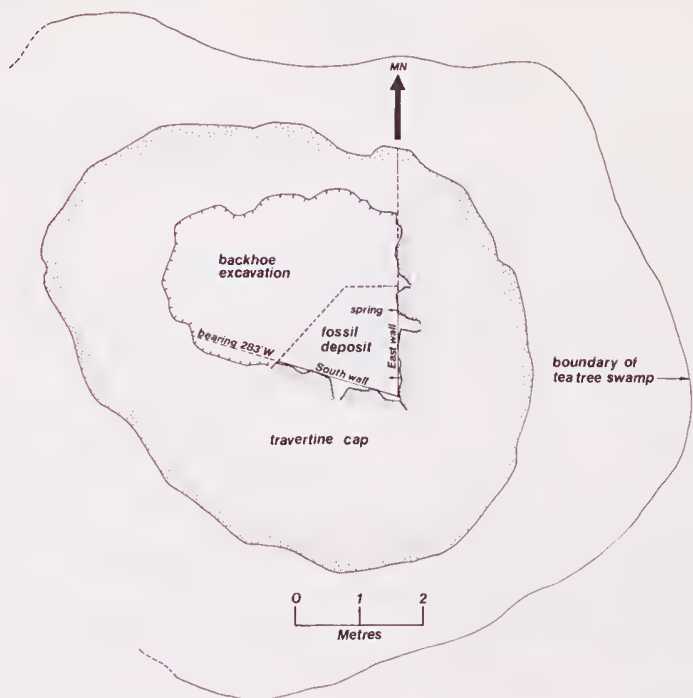


Figure 2 Sketch map of Porteous Spring Mound.

The spring mound which we excavated was discovered to be a fossil site by Mr. Laurie Porteous and is named here the "Porteous Spring Mound".

The darkly stained, perfectly preserved, fossil bones were sealed in clay lying beneath a dense travertine cap deposited by an artesian spring. This carbonate cap constitutes the "mound" from which the springs derive their name. Locally the travertine is called "iron stone" or "iron rock" because it contains small ferrous oxide pisolites that lend it a characteristic rusty orange-brown colour.

The spring mounds on the Waratah Plains differ from those at Mowbray Swamp in being considerably lower in profile and usually smaller in diameter and in being non-thermal. They also differ stratigraphically, issuing through a dense, homogeneous clay layer and lacking the stratified marl, peaty marl or peat layers.

The Porteous mound (Figure 2) rises about 50cm above the surface of the plain, its perimeter is marked by a ring of lush vegetation extending 2 or 3 metres beyond the perimeter of the travertine cap. This cap is oval in outline and measures 6.6 x 5.7 metres.

The mound previously supported a dense stand of tea trees (*Melaleuca* and *Leptospermum* spp.) attested by the presence of roots extending through cracks in the cap of the spring and into the clay below. The surrounding plain was originally sedgeland and tea tree swamp bordered by better drained areas that supported blackwood (*Acacia melanoxylon*). Higher ground on either side of the plain has a wet sclerophyll forest consisting primarily of *Eucalyptus simmondsii* and *E. ovata*.

The spring was very active even during the dry month of March, when the excavation took place. Water continually seeped from just below the upper clay sub unit. As the excavation proceeded, constant pumping succeeded in drying the upper and middle clay sub units and preventing seepage down the face of the excavation. However, water quickly refilled the lower part of the hole and it was necessary to repeat pumping every 15 minutes or so.

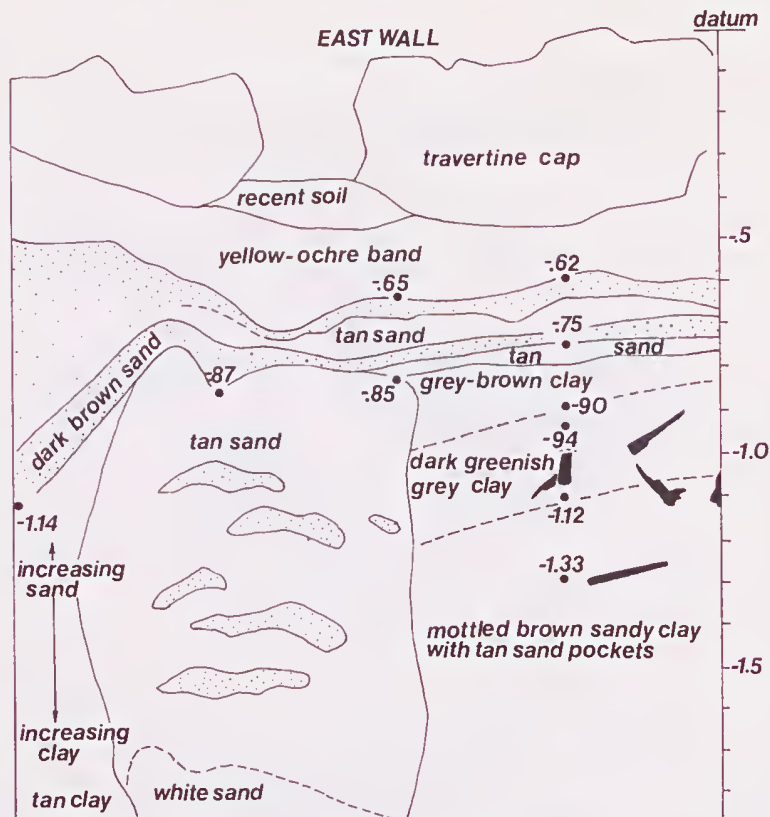


Figure 3 Stratigraphy — East wall of excavation.

STRATIGRAPHY

The deposit consists of four units (Figures 3 and 4). The lowest is a fine white quartzite sand of marine origin extending to an unknown depth. This is probably the equivalent of the Interglacial Mella Sands which underlie the spring mound complex at Mowbray Swamp.

A clay unit approximately 1 metre thick lies above this sand. The lower sub unit of the clay ("mottled brown sandy clay") contains a large sand component both in the form of pockets, and in various degrees of admixture with the clay, especially near the marine sand contact. This sand content decreases towards the middle of the unit (i.e. with increasing distance from the marine sands) and this lower sub unit ends at a depth of approximately 1.10 metres.

Above the mottled brown sandy clay is another sub unit — a dark greenish grey clay with a high organic content. This sub unit contains the greatest concentration of fossil bone and extends from 1.10 — 0.90 metres in depth. Above this are two further sub units, one grey brown clay and one brown clay with little sand and no fossil remains.

Above the clay unit is a narrow stratum of dark, organically stained sand below a thicker tan sand layer. Another dark brown sand layer occurs above the tan sand and at various places in the section are small lenses of tan or dark sand. This upper sand unit extends between the depths of 0.75 — 0.5 metres. The whole sequence is capped by the travertine deposit which averages about 0.5m in thickness.

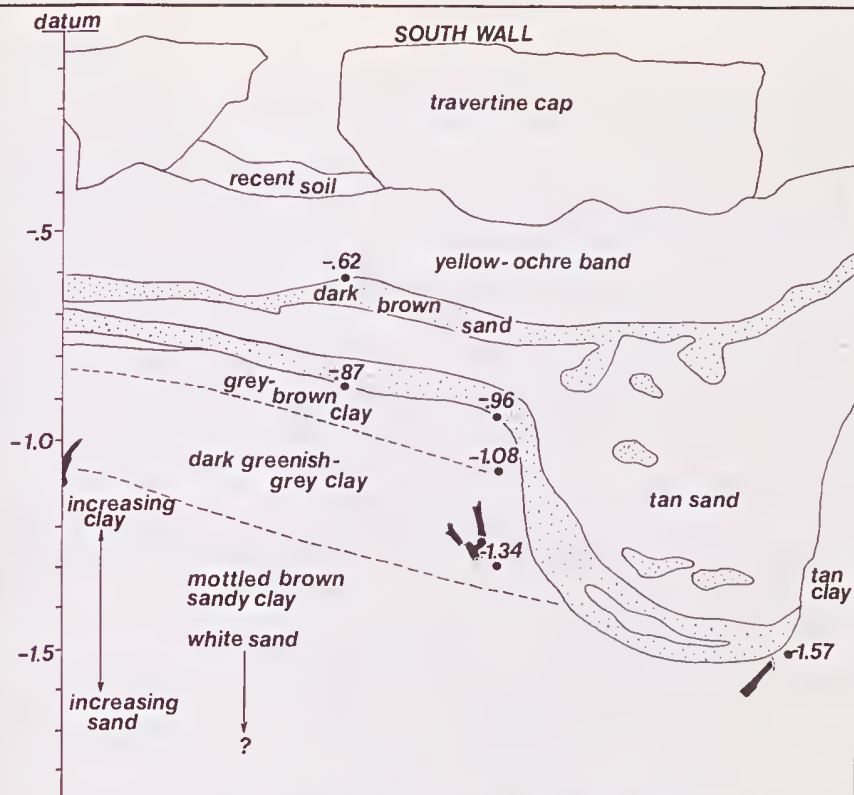


Figure 4 Stratigraphy — South wall of excavation.

In addition to the strata described above, two other major features are evident in the exposed section. A large column of mottled sand in the East wall, grading into the underlying unconsolidated marine sand, represents the main source of the spring. The mottled bands are a series of slumping structures, possibly related to the rise and fall of the spring head as a result of changes in the local water table. We suggest that the origin of this structure is a progressively widened fissure in the clay of an old channel of the Duck River.

A structure in the South wall appears to represent an old stream channel which has subsequently become filled with sand derived from the spring mouth. Mottled areas within this structure point to continued turbulence from the flow of spring water into this catchment. A portion of the same stream channel is also visible in the East wall.

Most of the fossil bones were found in the greenish grey clay sub unit, however some occurred in the lower clay sub unit and others in the marine sand unit and the spring mouth sand. Those in the spring mouth sand were probably eroded from the middle clay sub unit by the turbulence of the spring. The bones in the lower units are steeply dipping (sometimes vertical), suggesting that they have worked their way downwards as a result of the instability of the lower clay/marine sand interface.

Although the sections exposed on both walls of the excavation are small, it is evident that both the clay unit and upper sand unit are dipping (the dip is about 12-15° south on the South Wall, and about 8° to the north of the East Wall). This suggests that the clay beds represent the fill of a small sedimentary basin with steeply inclined sides. There are surface features on the Waratah Plain which represent old meander scrolls and filled oxbow lakes from the Duck River. The basin may therefore be an oxbow lake or a stranded meander which filled intermittently during high water or flood stages of the river.

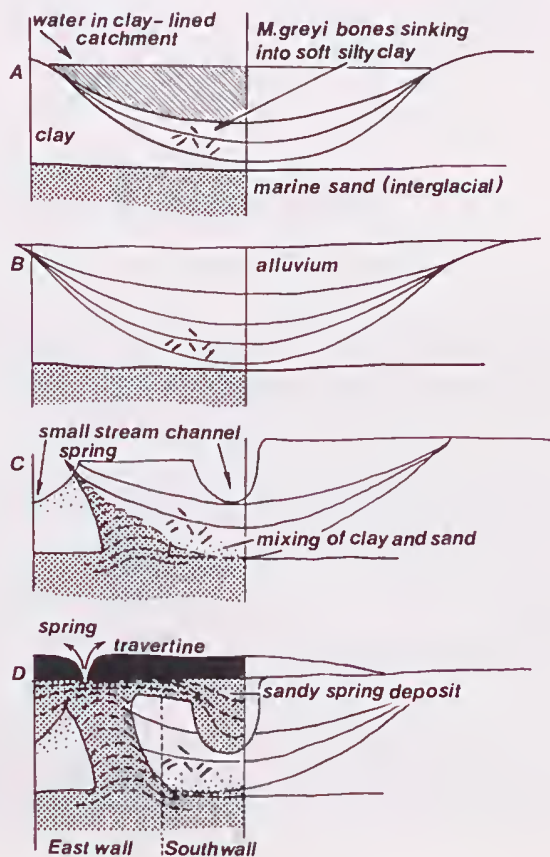
TAPHONOMY

The nature of the bone deposit, and the stratigraphy, allow us to draw some conclusions about the process of fossilization at this site.

The bones are not articulated, but they are not abraded, nor do they show the surface cracking and crazing associated with exposure on land. These facts indicate that (a) the bones were always in water, (b) they did not travel far, (c) the slight movement which occurred was as individual bones rather than whole carcasses. It seems likely that the skeletons were disarticulated before deposition but the bones still possessed collagen. Our hypothesis is that the animals died either at or close to the fossil site, the carcasses decomposed and individual bones were moved slightly by current action or simply settled differentially during siltation, thus leaving bones close together but no longer articulated.

The process we envision is as follows. The animals were perhaps caught in a flood while feeding in a dry oxbow lake or stranded meander. The carcasses were concentrated in one locality, perhaps by wind or current action and decomposed to form a localized deposit of bone. Repeated flooding silted up the basin and slightly unsettled the bones which were deposited in the clay sediments. Eventually the stream dried up or moved further away, but a second smaller stream at one time cut through part of the deposits and then its bed in turn become filled with sediment (Figure 5).

Water following the course of the original stream emerged as a spring and deposited sandy sediments in the stream channel. Eventually an ironstone cap was formed by the deposits of minerals from this spring and the formation of the spring mound was complete.



THE ANIMALS

(a) Identification

We have considered the problem of Identification here in some detail because of the lack of published information, and the restricted number of reference specimens of *M. greyi* which are available.

Finlayson (1927) noted two unusual features in the morphology of this species — (1) the muzzle was very thick and blunt and the length of the nasals was relatively very great, (2) the hind foot was not uniform in width but was strongly constricted in the centre.

Wood Jones (1923) noted that the second and third upper incisors were very small, and illustrated specimen M1762 from the South Australian Museum showing I³ with two grooves on the outer enamel surface.

Measurement of the complete skull excavated (Figure 6) at Edith Creek shows that the length of the nasals equals that of *M. greyi*. The length of the nasals is equal to that in the wallabies *M. parryi*, *M. dorsalis* and *M. rufogriseus*, although these species have a skull length 2.3cm greater than that of *M. greyi*.

The third incisors found in excavation do not resemble that illustrated by Wood Jones. Examination of the five specimens of *M. greyi* in the South Australian Museum shows that only the specimen illustrated by Wood Jones has two grooves, the others (and the fossil specimens) having a single groove near the posterior end of the tooth.

The mandible is the part of the skull most commonly found in fossil deposits and its Identification is more difficult than that of the whole skull. One of us (D.R.H.) has examined mandibles from the following species — *Macropus dorsalis*, *M. parryi*, *M. rufogriseus*, *M. parma*, *M. eugenii*, *M. greyi* and *Thylogale billardieri*. The first three of these can be separated from the rest by their much larger molars (M¹⁻⁴ > 27mm). *T. billardieri* can be separated from the three small wallabies by its much longer P³ (> 5.5mm). The other three species are harder to separate. *M. greyi* tends to have wider teeth than *M. parma* and *M. eugenii* (M³ protoloph > 5mm) but there is some overlap in this character. The main distinction is in the depth of the jaw. For individuals with full molar eruption, jaw depths for the South Australian Museum *M. greyi* specimens range from 13.5 — 14.0mm, and for the fossil specimens 14.0 — 16.0mm. Equivalent *M. eugenii* and *M. parma* specimens have jaw depths of less than 13.0mm. Although *M. greyi* has teeth only slightly larger than those of *M. eugenii* and *M. parma*, its mandible is as deep as that of *M. dorsalis* and almost as deep as *M. rufogriseus* and *M. parryi*.

Another feature which characterizes *M. greyi* is the distinctive metatarsal morphology (Figure 7). The outer side of metatarsal IV and the inner side of metatarsal V are extensively flattened so that these two bones fit very closely together centrally. On the fourth metatarsal this flattened portion is marked dorsally by a ridge which rises above the general dorsal surface of the bone. This metatarsal morphology explains Finlayson's observation that the hind foot is constricted centrally in *M. greyi*.

(b) Biology

Finlayson (1972), giving some observations on the biology of *M. greyi* comments on "its semi-gregariousness and localized discontinuous distribution throughout its range". He also notes the last "small band of perhaps fourteen individuals" (our emphasis).

Thirteen mandibles were found in the excavation (minimum number = 8 individuals). Of these eight (MIN = 5) had fully erupted molars, two (MIN = 1) had three molars erupted and two (MIN = 2) had M² almost fully erupted.

The greatest minimum number for any skeletal element was 11 (fifth metatarsal). Of fourteen metatarsal IV (MIN = 7), ten (MIN = 6) were adult and four (MIN = 3) were juvenile. For metatarsal V the figures are: total 16(11), adult 10(7), juvenile 6(4). The other bones analysed give similar age ratios except for femur and tibia which have a majority of juveniles.

◊——Figure 5 Diagrammatic sketches depicting formation of Porteous Spring Mound.

- (a) Sedimentary basin with low energy current. Fossils have entered the water and sedimentation has taken place.
- (b) Siltation of the stranded meander or oxbow complete.
- (c) Erosion of surface of oxbow sediments by small stream, break through of spring along slump created by unconsolidated marine sands containing artesian spring water. Mixing of lower clay unit and sands.
- (d) Spring carries sandy sediments to the surface where they are deposited in small stream channel cuts. Travertine layer deposited. Some fossils mixed with spring mouth sands and lower clay and sand units due to slumping and erosion.



Figure 6 Skull and mandible (from different individuals) of *M. greyi* from Porteous Spring Mound. (Scale = 1cm).

- (a) Dorsal view of skull. (1980/1/173).
- (b) Lateral view of skull. (1980/1/173).
- (c) Labial view of mandible. (1980/1/174).



Figure 7 Fourth (1980/1/175) and fifth (1980/1/176) metatarsals of *M. greyi* from Porteous Spring Mound. (Scale = 1cm).

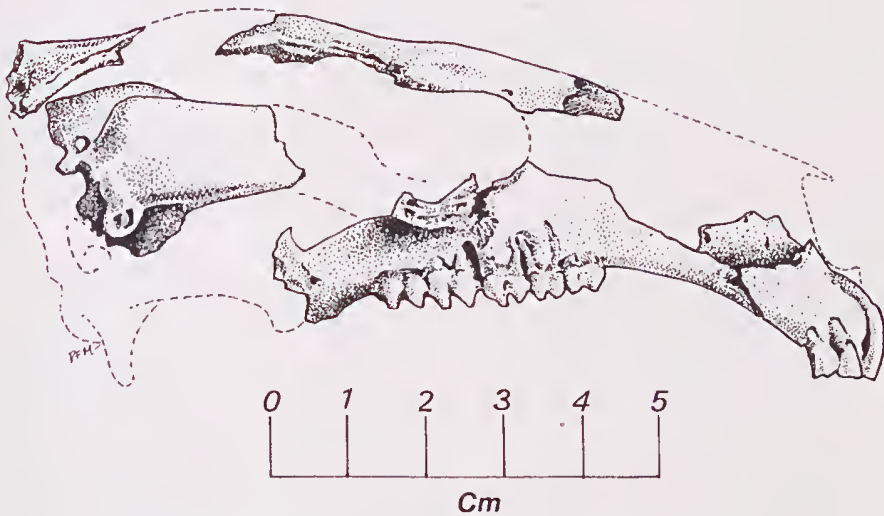


Figure 8 Restoration of *M. greyi* skull from Pulbeena Swamp.

The remains of *M. greyi* only were found in our excavation. This fact, together with the uniform preservation of the bone, suggest that the deposit was the result of a single event. We do not know how many bones remain unexcavated, but if the deposit is of limited extent, and if it is the result of a single geomorphological event, then the fossil deposit may represent the remains of a single band of the gregarious *M. greyi*.

Deciding on the cause of death of fossil animals is fraught with difficulty (Horton 1976), particularly when, as is the case with the Porteous Spring mound, there is no positive evidence available. The problem becomes even greater when we try to determine the cause both of the death of particular individuals and the extinction of the species in the area concerned.

The negative evidence at this site is as follows :

- (1) There is no evidence for predator action (either carnivore or man) — no cut marks or tooth marks, no fragmented bones, no burnt bones, no artefacts.
- (2) The animals present seem likely to be a cross section of a normal population (although there are relatively few young animals), and their death probably occurred as a single event — it does not seem likely that these are animals dying from old age whose bones have accumulated in one place for some reason.
- (3) There is little evidence of disease in the bones — two mandibles have the characteristic bone erosion of "lumpy jaw" (Horton and Samuel 1978) and one ulna has a thickening of the shaft of unknown cause.
- (4) There is no evidence that the animals became bogged. Although such evidence may have been lost during the deposition process, it does not seem logical to postulate bogging in the absence of evidence in favour of it.

It seems to us that the most likely explanation for the death of these animals is drowning. This may have occurred while crossing a stream, or the animals may have become caught and isolated by swiftly rising flood waters.

Post cranial material (1980/1/426) plus the figured specimens (1980/1/173-176) have been lodged with the Queen Victoria Museum and Art Gallery, Launceston, and the registration numbers are of that institution.

OTHER SITES

(a) Pulbeena Swamp

Fragments of a nearly complete skull (Figure 8) of *Macropus greyi* were collected by Mr. Gus Van de Geer from the upper levels of the Pulbeena swamp deposit. The fossil remains were in situ at about 115cm below the surface in a marly peat stratum 14c dated at $22,130 \pm 180$ (GRN 7689), (Colhoun, Van de Geer and Mook, 1977). This stratum yielded very high Graminae and Compositae pollen values indicating that *Macropus greyi* was present in the north west of Tasmania during the Late Last Glaciation (Margaret) when grasses and herbs were locally predominant (Colhoun, Van de Geer and Mook, 1977).

Pulbeena swamp material has been lodged with the Tasmanian Museum, Hobart.

(b) Cave Bay Cave, Hunter Island

Bowdler (1979) discusses the archaeology and Hope (1978) analyses the pollen from this site. A number of *M. greyi* remains were found in deposits dated to between $22,750 \pm 420$ and $14,850 \pm 190$. There is a hiatus in the deposits between $14,850 \pm 190$ and $7,180 \pm 90$, and no *M. greyi* was present in the levels dated at less than $7,180 \pm 90$ (J. Hope, pers. comm. and in prep.).

BIOGEOGRAPHY

We do not have a radiometric date for this deposit, but its age can be estimated on the basis of the following observations :

- (1) Spring mounds and associated deposits of Mowbray swamp have been dated as late Pleistocene by Gill and Banks (1956).
- (2) The complex series of events evident in the Porteous mound argues for a considerable antiquity, and such events would be unlikely under the heavy forest cover present in the valley at the time of European settlement.
- (3) The species is present at Pulbeena Swamp and Hunter Island in late Pleistocene times.
- (4) Finlayson (1927) noted that "The Toolach was essentially a clear country wallaby, avoiding both heavy timber and thick scrub, and in all parts of its range showed a marked partiality for grass country, not simply as a feeding ground, but as a "beat" in which practically the whole time of the animal, both feeding and resting, was spent".

According to Colhoun (1978) "at the time of man's first recorded presence ($22,750 \pm 420$ years BP) the regional vegetation of north eastern Tasmania was a grassland with local patches of shrubs and Eucalyptus woodland present. After $\sim 13,000$ BP there was eventually complete replacement of the grassland by *Eucalyptus* forest on dry sites with *Leptospermum* and *Melaleuca* scrub on damp or swampy sites with high water tables". As noted earlier, Colhoun, Van de Geer and Mook (1977) and Hope (1979) have found grass pollens in deposits in which *M. greyi* remains were found. The vegetation change at around 13,000 BP suggests that this is the most recent date at which *M. greyi* could have lived in north west Tasmania. After 13,000 BP the area became one which was suitable for *Thylogale billerdieri*, the species which still occurs there in large numbers today.

This habitat preference of *M. greyi* also suggests that during at least part of the period before 22,000 BP in which the Bass Strait land bridge existed, there must have been continuous grassland country along its western side from western Victoria to Edith Creek (Figure 9). This conclusion is in agreement with that reached by Hope (1978) on the basis of pollen evidence.



Figure 9 Distribution of *M. greyi*.

Circles — Specimens in South Australian Museum (Coonalpyn, Kingston, Robe).
Stipple — Distribution described by Finlayson.

Stars — Fossil localities: 1, Seton, Kangaroo Id; 2, McEacherns Cave; 3, Mt. Hamilton; 4, Warrnambool; 5, Cave Bay Cave, Hunter Id; 6, Porteous Spring Mound and Pulbeena Swamp.

CONCLUSION

Finlayson (1927) suggests that "although fringe country (i.e. the grasslands) is very extensive in the district, the whole of it was not occupied by Toolachs, the groups of which showed marked partiality for certain quite restricted areas, from which they were only driven by persistent persecution, and to which they returned again and again".

If the same behavioural pattern was characteristic of *M. greyi* in late Pleistocene times in north west Tasmania, the extinction of a complete band, as postulated at Edith Creek, would have depopulated a large area of country which would not have been recolonized for a long time. It may be that the behavioural characteristics of this species, in conjunction with its restricted habitat requirements, were a fatal combination in the changing world of late Pleistocene Australia.

It is well known that the ranges of many species were contracting before European colonization of Australia. In the case of the Toolach wallaby we can now examine such a change in some detail and assign tentative causes for it.

ACKNOWLEDGEMENTS

We are very grateful to Laurie Porteous of Edith Creek, who not only discovered the fossil site but helped us considerably during our excavations. His enthusiasm and encouragement was very much appreciated. We also thank Bob Green of the Queen Victoria Museum for bringing this site to our attention, and Jeanette Hope for allowing us to examine the macropod remains from Cave Bay Cave.

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